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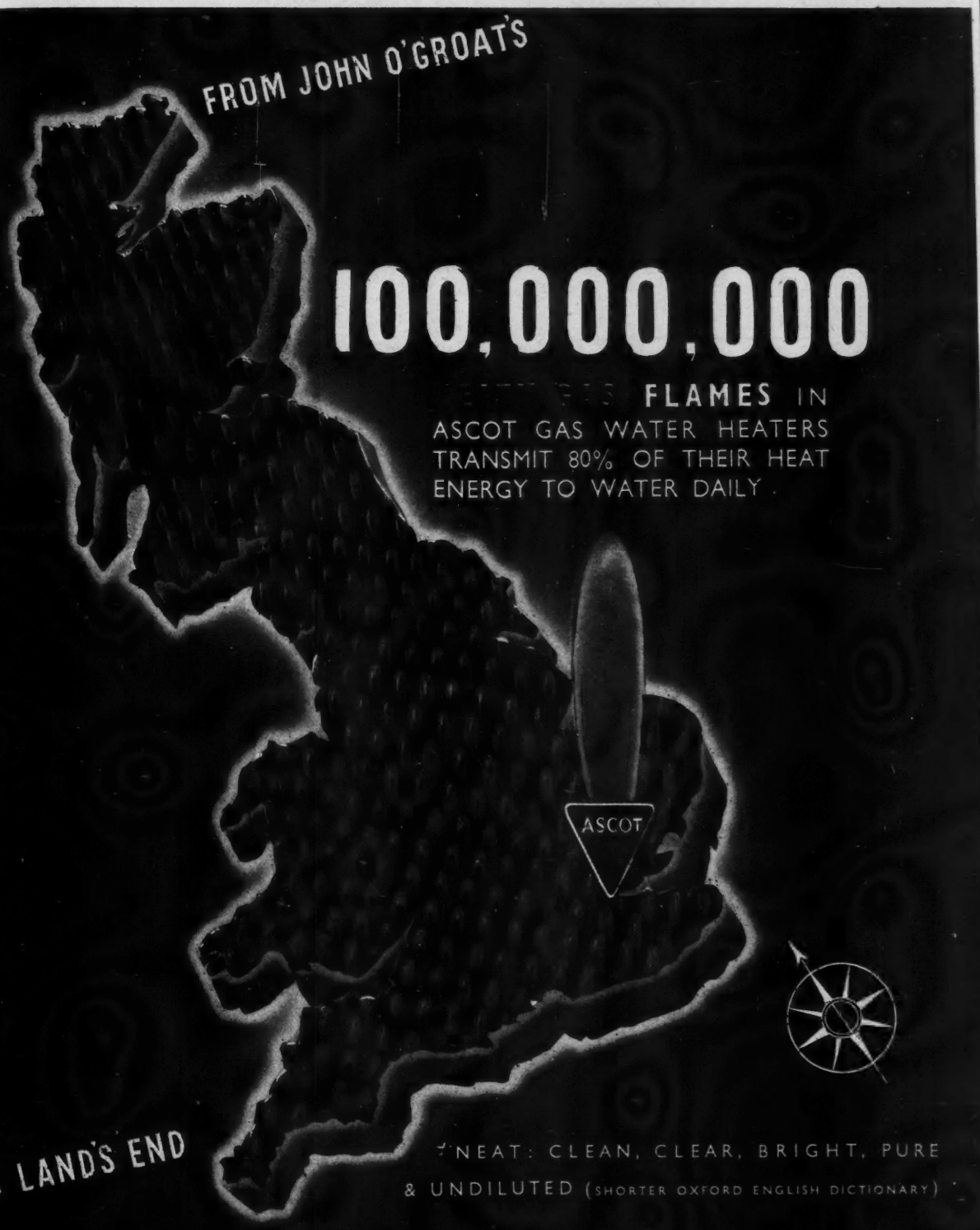
Gas Journal

LIGHT - HEAT - POWER - BY-PRODUCTS

Vol. 242. 95th Year. LONDON, SEPTEMBER 8, 1943. Registered as a Newspaper. No. 4190. Price 1/-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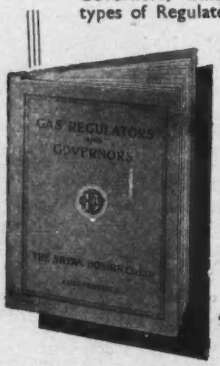

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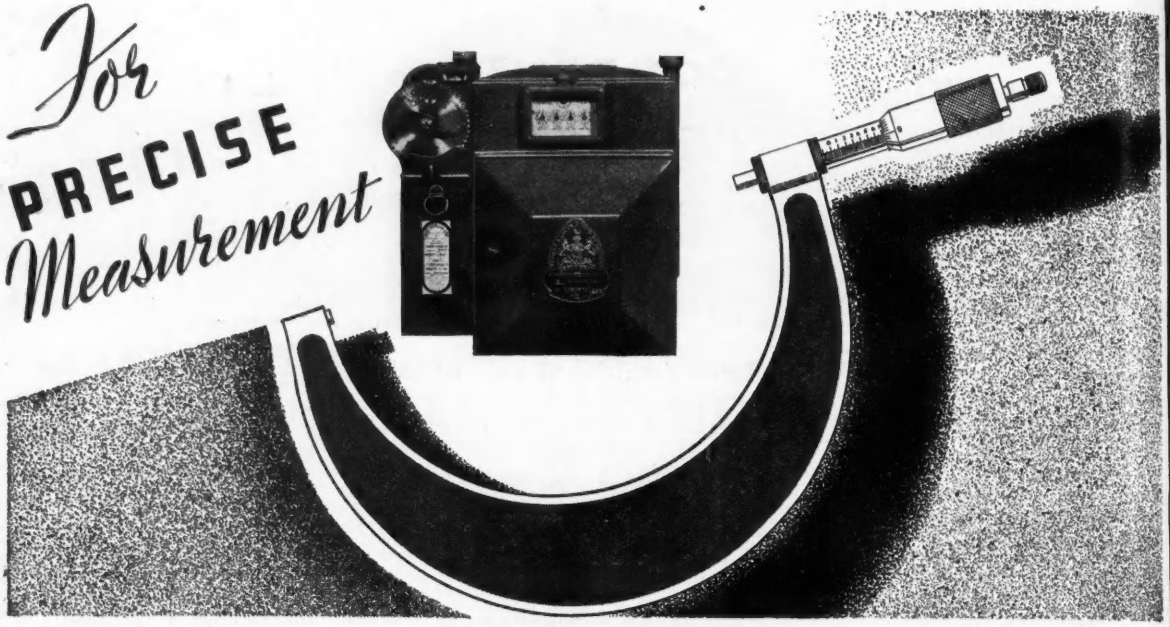

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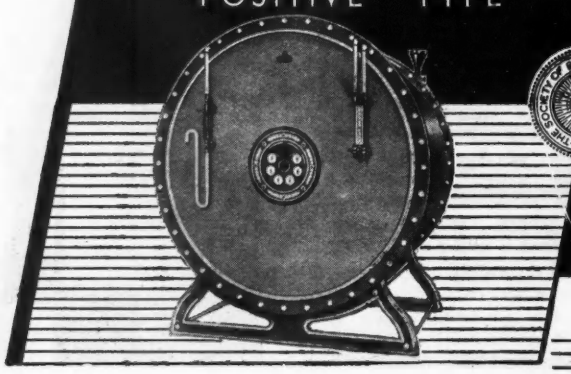

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P.6

GAS JOURNAL, SEPT. 8, 1943

VOL. 242 95th YEAR No. 4190

EDITORIAL NOTES

DOMESTIC HEATING

IN a "fireside talk" to the Institution of Heating and Ventilating Engineers last week Mr. A. F. Dufton, of the Building Research Station, D.S.I.R., reminded us of an article of his which we published in the "JOURNAL" twelve years ago. This article was concerned with the use of coke—gas coke—for room heating, and the Author gave an account of the satisfactory results he had obtained over a number of years in its use. The coke was not graded; it varied in size "more than do potatoes," and it was stored in the open. But it gave an excellent performance at a cost of under one-halfpenny an hour—and that was at a time when the possibility of producing a satisfactory smokeless fuel at a popular price was openly challenged in some quarters. There has been much improvement in the marketing of coke, suitably graded, since then, and also in the design of coke burning appliances, but we have still a long way to go before we can say that we are selling coke to the best all-round advantage. There are, however, grounds for optimism, for even under war conditions experiment with coke appliances of new design has, most fortunately, been continued. We look forward to some very convenient and very economical coke-burning appliances for domestic heating after the war. We have examined several examples, though the time is not ripe for their detailed description.

It is some years since the Editor of *Nature*, in invoking support for the prevention of atmospheric pollution, suggested that improvement of the quality of smokeless fuels would be materially assisted by observations made in their private capacity by scientific workers who adopted smokeless methods of heating. There is much to be said in favour of exchanging the information which we all must acquire in our homes on this vital subject of warming them comfortably and conveniently and providing cooking and hot-water facilities, and last week's talk by Mr. Dufton, who is a very good lecturer, about some of his domestic experiments and experiences was one which naturally interested us very much indeed. There is not, we suggest, any one cut and dried solution to the problem of arranging for domestic heating. Houses differ, people's inclinations differ, climatic conditions are not uniform throughout the country, and, above all, people's habits, working life, spending capacity, and requirements differ enormously. So what would suit Mr. Dufton, who lives in a house which cannot be described as small, would not suit the "bachelor girl," for instance. But there are, we think, one or two fundamental considerations. In the average winter in this country we need, for comfort, a considerable volume of heat input. During cold spells we become suddenly aware of the quantity of heat we do need, and we are fortunate in being able to store heat for the purpose in solid form. The Gas Industry, of course, has considerable gas storage capacity, but when we recall the cold snap of February, 1929, we think we are right in saying that the huge gas loads imposed upon it at that time could not have been met if the Industry had not also solid and liquid fuel storage capacity. Another consideration is that we have been very wasteful in our use of solid fuel in the home; post-war we cannot afford such unnecessary waste. And a further consideration is insulation, not only of hot-water tanks and pipes and the like, but of the fabric of the house itself. We do not know how much fuel could be saved by such insulation, but it must be an enormous quantity, and we may find that insulation will very greatly modify our conceptions of domestic heating generally.

SPEEDY OR SLOW ?

WE are, however, rather running away from Mr. Dufton's talk. Mr. Dufton favours solid smokeless fuel; he made no mention at all of gas or electricity. His heating installation consists of four stoves, a cooking range, and a boiler, all gravity-fed with solid fuel and all under thermostatic control; he has retained only one open fire. Even when the fire doors are open, the stoves are under thermostatic control, and the increased radiation then afforded helps to compensate for the fall in air temperature. The cooking range is of the heat-storage type, and Mr. Dufton waxed lyrical about it and about the "new method of cooking which this type of cooker has made practicable"—a method which, in his household has completely ousted the traditional way of roasting meat. Entirely ignoring the virtues of grilling, he said that the proof of the cooking is in the eating, and he finds very delicious shoulders of mutton cooked for 15 hours in an oven controlled at about 212°F. The meeting began at 6 o'clock, and by the time the lecturer had amplified his comments on cooking by quotations from Mrs. Beeton and Count Rumford, we felt uncommonly hungry. Later we found our meal (not, by the way, a shoulder of mutton) cooked by gas in a thermostatically controlled cooker, "delicious," so maybe there is still something to be said for speedy cooking, especially from the point of view of the housewife. However, there is no doubt that several of the nicer points of cooking remain to be explored, though incidentally we do think that much depends on the quality of the raw material and one's relationship with the butcher. And, though not reactionary, we recall with lasting gratitude that our grandmother (who did not teach us to suck eggs) was well versed in the art—or should we say science—of roasting poultry on a spit. And we recall . . . but such thoughts, perhaps, are not good for us in wartime.

We turn to Mr. Dufton's water heating arrangements. Storage for 90 gallons of hot water is provided, and the water is heated by a small boiler giving a steady output day and night; the consumption of fuel under normal conditions is about 10 ounces per hour. There is a main cylinder which holds 70 gallons and a 20-gallon hot tank; 60 gallons can be isolated from the circulation, so that, starting from cold, only 30 gallons need be heated up. If the isolating valve is closed when the cylinder is full of hot water, exceptionally hot water can be obtained without increasing the rate at which the fuel is burned; the heat is supplied to only 30 gallons of water, and until 60 gallons have been drawn the boiler is fed with hot water. The essense of the installation, if we interpret Mr. Dufton's remarks aright, is ample, insulated storage combined with a low-capacity boiler which, however, can be regulated. An "accidental" feature of the installation is that the hot-water pipe to the bath passes round the bath and keeps it warm. For many years we enjoyed such an "accidental" feature, and we can vouch that, on very cold mornings, it is far preferable to be able to sit in a warm bath as distinct from sitting in a cold bath containing hot water—that is, if we are in a hurry, and we usually find ourselves a bit rushed, as it were, at that time of day. For those who do not have to shave, the "cold bath effect" must be more acute.

We come to the open fire. In 1802 Count Rumford wrote: "To make a good fire in a bad grate, the bottom of the grate must first be covered with a single layer of balls made of good firebrick or artificial firestone. . . . On this layer of balls the fire is to be kindled, and, in filling the grate, more balls are

to be added with the coals that are laid on." Mr. Dufton incorporates fireclay balls in his own open fire, which, he explained, has been contrived as an "air warming fireplace which delivers probably three times as much useful heat from the fuel as the fire which it replaced." The fire opening is kept low and above it is a metal "trumpet" terminating in a throat of 15 sq.in., which "trumpet" serves to heat the air as well as to transmit radiant heat. The Author also described a wartime economy measure in connexion with one of his heating stoves—the placing of a metal drum behind the stove, and causing the hot flue-gases to pass through the drum before entering the chimney. This, again, being an air heater.

CATHOLICITY

MR. DUFTON then gave a description of a specialized installation fired by solid fuel, arranged by one capable of applying scientific principles to everyday life. These principles are, we suggest, of more than particular application and extend to forms of heating other than solid fuel. We should, we must, pay more attention to fuel economy, to heating by a combination of radiation and convection, and to adequate insulation together with adequate heat input for comfort irrespective of weather conditions. The Author did not touch upon either capital costs or running costs. We cannot think the capital costs were low, though we can well imagine that the running costs in relation to the service given are reasonable enough. Of course, Mr. Dufton has not solved the labour problem and with his various stoves he must have a fair amount of running about with ash pan and brush, and he has to feed fuel to them. We ourselves should favour a more catholic installation, including a considerable measure of heat on tap as well as in the form of solid lumps of smokeless fuel. Obviously, though, Mr. Dufton has struck the nail of comfort on the head by insisting that the basis plan should be to provide an adequate volume of heat; and, as we have suggested, the Gas Industry must face up to the fact that a house does require a good *quantity* of useful heat, irrespective of the convenience factor. We have the feeling that Mr. Dufton's home is comfortable because he has realized first and foremost the importance of the factor of heat quantity. We should not, we imagine, shiver in his home when the temperature happened to drop ten or fifteen degrees in winter; we should not have to suffer the discomfort of a numbed mind which indoor cold induces. Again, as we have said, Mr. Dufton's installation is a specialized one. We believe that with its two forms of smokeless fuel, the Gas Industry is capable of covering the general field, providing both radiant and convected heat by both gas and coke, for which purpose a gas low in sulphur is essential. We seem to have written quite a deal about Mr. Dufton's fireside talk; our excuse, if apology be needed, is that we enjoyed it and had the fact impressed upon us once again that solid smokeless fuel has a big part to play after the war. If the Gas Industry does not want the solid fuel market for domestic heating, somebody else will take it—with, we think, both pleasure and profit.

GAS LIQUOR PROCESSING

TOGETHER with Mr. Nicol Baird, Mr. P. Parrish, whose work on the subject is widely known, both within and outside the Gas Industry, gave a Paper on Friday last to the North British Association of Gas Managers on the processing of gas liquor. An extract from the Paper, which consists of a technical and economic survey of the question, will be found on later pages of our issue to-day, and it should prove very helpful. The practical treatment contains operational information of two vapour-phase gas liquor concentration plants recently installed; it is, however, to the general aspect of the processing of liquor, as dealt with by the Authors, that we would call attention briefly here. Pointing out that ammonia and sulphur are inter-related in more ways than one, it is contended that the Gas Industry has failed to appreciate this interrelationship adequately; the less the quantity of ammonia gas undertakings recover—or, to put it another way, the more ammonia that is wasted—the greater will eventually become the problem of the disposal of spent oxide. The Authors argued that if only 5½ lb. of ammonia is recovered per ton of coal carbonized, there will be surplus sulphur to the extent of 6½ to 8½ lb. per ton of coal carbonized, which, having regard to the weight of coal carbonized annually, is a formidable quantity. Spent oxide, they went on, should be made an attractive material for the manufacture of sulphuric acid, but too often one finds unduly large quantities of ammonia passing to the purifiers, on the pretext that it is necessary to maintain the purifying material in an alkaline condition; again, just as it is important to produce a satisfactory quality of spent oxide, so it is equally important to retain as much undecomposed ammonium sulphide in the concentrated liquor as possible, so that sulphur, as well as ammonia, is transported to the central chemical works.

Here are a few further generalizations: If concentrated gas liquor is to be manufactured economically, gas liquor must be produced of satisfactory quality and strength. The saving in steam alone when processing gas liquor of 2% free ammonia, in contrast with 1% free ammonia, is 9s. per ton of concentrated gas liquor, based on steam at 4s. 6d. per ton. This represents an economy of 5.4d. per unit. Wherever possible it is advisable to use waste heat steam. The larger the production unit for concentrated gas liquor, the cheaper the final product. The difference of price between a unit of plant of a capacity of 3 tons per day and one of 20 tons capacity per day of concentrated gas liquor is not appreciable. Concentrated gas liquor stills, if properly designed and fabricated, should serve for at least 30 years. Depreciation is not serious. Little labour, unskilled at that, is needed in the manufacture of concentrated gas liquor. Chemical supervision can be developed in such a way that at larger works 6d. per ton should adequately cover this item. Atmospheric coolers should be installed wherever possible in order to economize in the use of condenser cooling water. In this way the consumption can be reduced, usually by as much as 90%, which represents a saving of no mean order. And, reverting to sulphur in the spent oxide, the Authors gave figures to show the additional income from the sale of spent oxide, *via* product ammonia.

Electricity Supply Organization

Writing in the *Electrical Review*, Mr. S. E. Monkhouse expresses some interesting views on post-war development of electrical supply. If, he says, the industry is to provide the best service to the consumer, the best conditions for its employees and earn an adequate return on its invested capital, no matter by whom it is owned—whether by companies, local authorities, or by area boards—the country must be divided up into a number of large, self-contained economic areas and all "island" authorities must be eliminated. Each area should be so selected that so far as possible it includes a variety of loads—*i.e.* power supplies, urban supplies and rural distribution. It is, he thinks, important that each area should have complete autonomy, including the control of expenditure and the raising of money for capital works—in other words, development must not be hampered by Whitehall.

It should, he adds, be an essential in any scheme of reorganization that continuity of management and policy should be ensured, that there should be a rigid control of profits, and, finally, there should be a complete divorcement from political control, both national and local. If some such fundamentals as these could be agreed, then, he concludes, some progress would have been made.

Gas and the War Effort

Considerable interest will have been aroused by the series of announcements by the Parkinson & Cowan Group of Companies which is appearing in our advertisement pages. Under the title "Gas Gets to Grips," the announcements tell briefly, vividly, and to the point something about what the Gas Industry of this country is doing in helping to win the war; and we think it will be agreed that the story is being told effectively by both word and picture. The series, it is suggested, may help especially the district personnel of those undertakings in non-industrial areas to give gas consumers an idea of what is being accomplished by gas.

Personal

Mr. A. ENTWISTLE, Distribution Superintendent, Darwen Gas Department, has been appointed to a similar post with the Northwich Gas Company.

* * *

Mr. T. D. OLVER, Chief Assistant Engineer to Burnley Gas Department, has been appointed Deputy Gas Engineer and Manager in succession to Mr. J. Pollard, who recently accepted the Managership of the Darwen Gas-Works.

Letters to the Editor

Advantages of Opposition

DEAR SIR,—The Minister of Fuel and Power and the Gas Industry at this moment are both faced by the same dilemma. The Gas Industry is at fault, not the Minister. Let us face the facts. The Gas Industry, in my opinion, has no leaders with the necessary rank and authority vested in them by a properly constituted election and the votes of the whole Gas Industry. Before such election can take place there should be at least two factions or parties, as are concerned with our own Parliament.

What could be better to start with than a fight between those who believe in producing about 60 therms to sell in the richer gases, using about 25% of the coal heat, or 5 cwt., together with 60% of the coal heat, or 13 cwt., to produce coke for sale on the one side: and on the other side those who believe in complete gasification of coal, or something near it, which will produce gas of a less rich quality up to a production of, say, 200 gas therms per ton, representing about 80% of the coal heat, or 16¾ cwt., and varying from very little to no coke for sale.

Every man really concerned in the Gas Industry knows that this is the fight in the minds of the Industry which has to take place; and the sooner the battle is started the better.

Unfortunately there is a fairly large section which for personal reasons seeks to evade this issue. It just cannot be done. If the Gas Industry will not arrange for this fight, then the Minister should, I venture to suggest, bring it about. Let a general meeting be held at the Albert Hall (if that is big enough) for the Industry and the public and continue from day to day until this question is settled. The remaining questions would then settle themselves.

Gas-Works,
Nuneaton,
Aug. 30, 1943.

Yours faithfully,
GEORGE HELPS.

Submerged Combustion

DEAR SIR,—I would like to draw the attention of your contributor, Mr. F. E. Lane, who wrote the article on "Submerged Combustion" which appeared in your issue of August 25, to my Paper on the subject. It appeared in the *Transactions of the Institution of Chemical Engineers*, Vol. 5, 1927.

Dukes Road,
Western Avenue, W. 3.
Aug. 30, 1943.

Yours faithfully,
for NORDAC LIMITED,
NORMAN SWINDIN.

The fact that goods made of raw materials in short supply owing to war conditions are advertised in the "Journal" should not be taken as an indication that they are necessarily available for export.

Diary

Sept. 14.—Federation of Gas Employers: Central Committee, Gas Industry House, 12 noon.
Sept. 14.—National Gas Council: Central Executive Board, Gas Industry House, 2.15 p.m.
Sept. 16.—Association of Gas Corporations: Council, 3.30 p.m., Gas Industry House.
Sept. 20.—London and Counties Coke Association: Finance Committee, 10.30 a.m.; Executive Committee, 11 a.m.; Central Committee, 12 noon; Annual Luncheon, 1 p.m.; Annual Meeting, 2.45 p.m., at the Waldorf Hotel, Aldwych, W.C. 2.
Sept. 22–23.—Association of Public Lighting Engineers, Institution of Mechanical Engineers, S.W. 1.
Sept. 30.—Institute of Fuel, Paper by R. Lessing, Institution of Electrical Engineers, Savoy Place, W.C. 2, 5.30 p.m.
Oct. 6.—Southern Association of Gas Engineers and Managers (Eastern Section), Paper by Dean Chandler, entitled "Gas Flames, the Case for Aeration entirely at the Point of Combustion," Gas Industry House.
Oct. 11.—National Federation of Gas Coke Associations: General Committee (Special Meeting), 2.30 p.m., Gas Industry House.
Oct. 12.—National Federation of Gas Coke Associations: General Committee, 10 a.m., Gas Industry House.
Oct. 14.—Institute of Fuel, Annual Meeting and Luncheon, Connaught Rooms, Great Queen Street, W. 2.
Oct. 18.—Institute of Fuel (North-Eastern Section), Address by J. G. Bennett, Director B.C.U.R.A., Central Station Hotel, Newcastle-on-Tyne, 5.30 p.m.
Nov. 26.—Southern Association of Gas Engineers and Managers (Eastern Section), Paper by Dr. Weston and Dr. Haffner, entitled "New Evidence in regard to the Mechanism of Carbonization in Continuous Vertical Retorts," Gas Industry House.

A.P.L.E.

The Association of Public Lighting Engineers is meeting at the Institution of Mechanical Engineers, Storey's Gate, S.W. 1, on Sept. 22 and 23, under the Presidency of Mr. E. J. Stewart, M.A., B.Sc., of Glasgow. Apart from the Presidential Address five Papers will be given. The titles and speakers are:

"Street Lighting—Past, Present and Future," by J. M. Waldram.

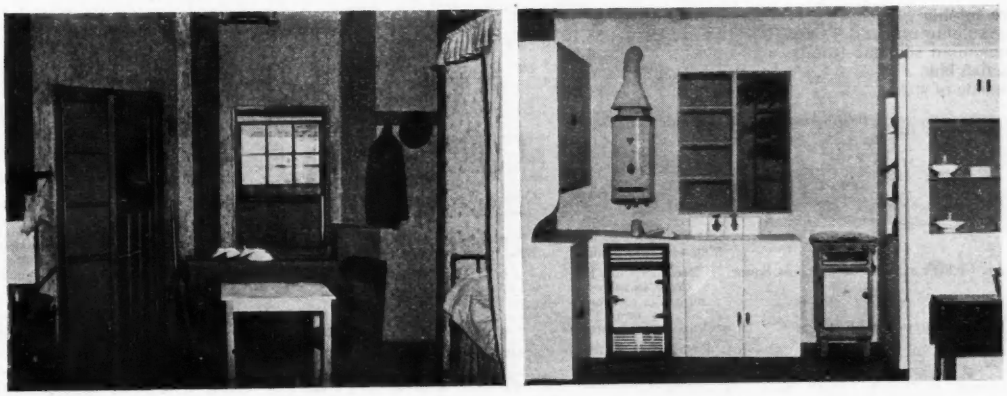
"The Design of Lamp Columns and Fittings in Relation to Post-War Town Planning and Reconstruction," by H. C. Bradshaw, C.B.E. (Secretary, Royal Fine Art Commission), and Dr. S. English.

"Post-War Street Lighting, with Special Reference to Gas," by W. J. G. Davey, and W. Hodkinson.

Further details of the Conference may be obtained from the Secretary, Mr. H. O. Davies, 68, Victoria Street, S.W. 1.

The Employees of the Chester United Gas Company played their part in the local "Wings for Victory" week held recently. The invitation to adopt a target of £250 was accepted. This was exceeded in the first few hours, and the final total reached over £2,540. At a public function in the Town Hall, a "Certificate of Honour" was presented to the Secretary of the Company's Savings organization who, with other workers, represented the employees.

CONTRAST



The Edinburgh Architects' Association recently decided to hold an exhibition and invited the co-operation of the Edinburgh Gas Department, whose effort is depicted in our photograph, which shows, on the left, a kitchen which was accepted as good standard towards the latter end of last century. On the right is an example of gas service in a kitchen of the type to-day.

THE PROCESSING OF GAS LIQUOR: A TECHNICAL AND ECONOMIC SURVEY*

By W. NICOL BAIRD, B.Sc., A.M.I.Mech.E.,
Engineer and Manager, Corporation of Perth Gas Department; and
P. PARRISH, F.I.C., M.I.Chem.E., F.I.I.A.

GAS undertakings in Scotland are for the most part small or of medium size, and since the two largest works—Glasgow and Edinburgh—adopted processes for the concentration of gas liquor at least ten years ago, it would seem opportune on this occasion to confine attention to the processing of gas liquor at small and medium-sized works.

The first requirement is to ensure if possible the production of gas liquor of satisfactory quality—*i.e.*, of not less than 2% total ammonia, with a relatively low content of CO_2 (say, not exceeding a ratio of 1.0 ammonia to 1.4 CO_2) and as free as possible from dissolved hydrocarbons derived from tar.

Ammonia and sulphur are inter-related in more ways than one. The Gas Industry has apparently failed to appreciate this inter-relationship adequately. The less the quantity of ammonia gas undertakings recover, or, to put it in another way, the more ammonia that is wasted, the greater will eventually become the problem of the disposal of spent oxide.

Singularly few gas undertakings are recovering more than 5½ lb. of ammonia per ton of coal carbonized, whereas under sulphate of ammonia conditions 30 lb. of sulphate of ammonia (25% NH_3) was almost invariably recovered per ton of coal carbonized.

Thus:

25% of 30 lb. of sulphate of ammonia	=7.5 lb. NH_3.
As the fixed ammonia which is of the order of 20% (Durham coals) represents	1.5 lb ,,
there remains a target figure of	6.0 lb. NH_3.

Or, if concentrated gas liquor, 20% by weight is made, then 30 lb. concentrated liquor (*i.e.*, 6 lb. NH_3) per ton of coal carbonized will be the target figure.

The quantity of sulphur recovered per ton of coal carbonized, where Durham coals are used, is 12 to 14 lb.

$$\frac{S}{32} : \frac{(NH_3)_2}{34}$$

From the above it is seen that if only 5½ lb. of ammonia (=27½ lb. concentrated gas liquor) is recovered per ton of coal carbonized, there will be surplus sulphur to the extent of 6½ to 8½ lb. per ton of coal carbonized.

This constitutes a formidable quantity, having regard to the weight of coal carbonized annually in this country.

Spent oxide should be an attractive sulphur material for the manufacture of sulphuric acid. The contents of tar and ammonia should not exceed 1% and 0.5% respectively, and the material should be of uniform physical texture and free from lumps, particularly where spent oxide has to be used in mechanical burners.

One is brought in contact, from time to time, with consignments of spent oxide showing the following analysis:

Moisture	9.50%
Sulphur and tar	54.02%
Tar	1.38%
Pure sulphur	52.64%
Pure sulphur on the dry basis	58.10%
Ammonium sulphate (total)	4.90%
Prussian blue	6.97%
Prussiate of soda	11.80%

* From a paper to the North British Association of Gas Managers, Sept. 3.

By reason of the abnormal quantity of ammonium sulphate, otherwise excellent material, from the prussiate of soda viewpoint, has to be discarded, because inconvenience is caused to operatives engaged in the extraction of prussiates.

Too often one finds unduly large quantities of ammonia passing to the purifiers, on the pretext that it is necessary to maintain the gas purifying material in an alkaline condition.

Greater attention should be given to the physical and chemical characteristics of the purifying material introduced to the boxes. Oxide of iron with a less pH value than 8 should never be introduced, and such an alkalinity may be derived more cheaply from slaked lime of satisfactory particle size than from the use of other material. As much care should be taken to produce a saleable spent oxide as is normally given to produce tar of suitable chemical characteristics.

Just as it is important to produce a satisfactory quality of spent oxide, so it is equally important to retain as much undecomposed ammonium sulphide in the concentrated gas liquor as possible, so that not only ammonia, but sulphur, is transported to the central chemical works.

From the outset of the utilization of concentrated gas liquor, one of the authors has consistently advocated the production of concentrated gas liquor of as high an H_2S content as possible, consistent with reasonably satisfactory storage and transport. Indeed, provision has been developed at central chemical works for discharging tanks containing up to 50% of crystallized product, largely because the transport costs are favourable with the higher concentrations of ammonia and sulphur.

Concentrated Gas Liquor v. Liquor Ammonia

Technicians associated with the Ministry of Supply (Industrial Ammonia Control) have expressed the view that possibly it would have been better to produce liquor ammonia, rather than concentrated gas liquor. But certainly a knowledge of the economics of the operation of ammonia plants throughout the country, of various types, does not justify this view. Increased steam consumption, transport of ammonia *per se*, and loss of ammonia in the filling and discharge of tanks are factors militating against the economics of liquor ammonia production, as a study of the following figures and their implications will reveal.

In the production of concentrated gas liquor the problem at one time was "to lime, or not to lime." But in these days, when the production of commercial lime is surrounded with difficulties arising out of the blackout, and when suitable labour at most gas-works is at a premium, no one would willingly contemplate liming. Those plants which have operated under semi-automatic liming conditions have produced a concentrated gas liquor of consistent and satisfactory strength, and have manufactured more concentrated gas liquor than sulphate of ammonia, as the following figures reveal:

TABLE II.

Years.	Coal carbonized. (Tons.)	Ammonia product made. (Tons.)	Average percentage of ammonia.	Ammonia recovered. (Tons.)	Ammonia recovered per ton of coal. (Lb.)
1930–35 inclusive	375,605	3,826	25.5	975.6 (sulphate)	5.82
1937–40 inclusive	277,868	3,705	19.6	726.2 (concentrated gas liquor)	5.85

TABLE I.

Product.	Method of production.	Quality of gas liquor. Total NH_3 %.	Quality of gas liquor. Fixed NH_3 % of total.	Analysis of product. NH_3 %/wt.	Analysis of product. H_2S %/wt.	Steam consumption lb./100 lb. of gas liquor.	Efficiency of process.
1. Crude concentrated ammonia liquor	Decarbonation by steam and fixed ammonia recovered by lime	2.0	30–35	25–26	0.5	38–42	88–90
2. Concentrated gas liquor	Vapour phase process	2.0	18–20	18–20	2.5–3.5	20–22	94
3. Ditto	Partial decarbonation initially	2.0	18–20	20	2.5–3.5	26–28	93
4. ,,	Straight distillation	2.0	18–20	15	2.75–4	18–19	95–96
5. Liquor ammonia	Decarbonation by steam and liming to remove traces of CO_2 and H_2S and fixed ammonia	2.0	20	25	—	36	88

Experience since 1939 leads to the view that where small works are concerned and where technical assistance is lacking, or at a minimum, it is desirable to produce concentrated gas liquor of 15% strength in straight plants of the type adopted at North Berwick more than twelve years ago. Small and medium-sized works, however, are generally unfavourably placed geographically in relation to the large central chemical works, and the major consideration may be one of reducing transport costs, if concentration of gas liquor is to prove economical. In such cases one or other process of partial decarbonation must be adopted.

Whether an emergency plant* should be erected or a more elaborate one installed depends largely on economic considerations. Obviously the emergency plant will be less expensive in respect of capital expenditure than the more elaborate plant.

In a straight plant, manufacturing concentrated gas liquor of 15% NH_3/wt., no definite attempt is made to decarbonate; but in point of fact, dissociation of the ammonium carbonates and ammonium sulphides of the gas liquor actually occurs, because, to meet the provisions of the Alkali Works Regulations Act, it is necessary to wash with water or ammoniacal liquor the gases displaced from the storage tank, and to pass these, after the removal of ammonia, to an oxide of iron purifier, for the absorption of traces of dissociated H_2S. In a straight plant there can be a limited degree of decarbonation, dependent on the temperature at which the concentrated gas liquor is introduced to the storage tank. If the water to the condenser is restricted, so that the temperature of the concentrated gas liquor reaches 40°C., as against 20°C., the possibility of blockages in the condenser is reduced, while incidentally a greater quantity of unabsorbed ammonia, CO_2 and H_2S will pass into the storage tank. In this way a greater amount of ammonia is absorbed by the scrubber above the tank. Generally speaking, by operating in this way a greater throughput of a slightly higher ammonia concentration can be obtained.

There are, however, limits to this method of working, and obviously the logical development is to resort to vapour phase decarbonation, where at some point in the condenser system CO_2 and H_2S are bled off, along with a certain amount of ammonia. This allows for the passage of the concentrated gas liquor to the storage tank at a lower uniform temperature, say 30°C.

Elsewhere it has been made clear† that with gas liquors containing an ammonia/CO_2 ratio of 1 : 1.36 there is little need for partial decarbonation. Indeed, concentrated gas liquor of 20 to 22% ammonia by weight can be manufactured in a straight plant. This significant fact should never be disregarded, since from an economic point of view the straight type of plant is manifestly advantageous. The tighter the retort mouthpieces the better, as regards ammonia and CO_2 ratio, will be the quality of gas liquor produced. Equally, the better the control and "cracking" of steam to the retorts, the better will be the ammonia/CO_2 ratio.

There is no doubt that the vapour phase process is more economical than any other where an unfavourable quality of gas liquor has to be treated. A plant of this type is more economical in three respects: (1) Capital expenditure, (2) steam and water requirements, and (3) efficiency.

With regard to the design of vapour phase concentrated gas liquor plants, the following important considerations have emerged as a result of operational experience over the last four years.

(1) It is desirable that such plants should be self-contained and that all gas liquor should remain in circuit. This can be achieved by the provision of a balance tank, to which all scrubber liquors should be introduced, together with the gas liquor to be distilled. The balance tank can be eliminated if arrangements are made to place a scrubber for the dissociated gases above the still, preferably at the side.

(2) The greatest difficulty militating against correct design of plant, particularly as regards size of the primary and secondary condensers, arises from fluctuations of the temperature of cooling water between winter and summer weather conditions, and the actual site on which the plant is located. These condensers, if situated in an exposed position, should be protected against the effect of cold winds and the direct rays of the sun by the provision of simple wooden louvre-type shields.

(3) All "Arca" regulators, whether for water or gas liquor, should be provided with compensating relays, so as to minimize the effect of time-lag, and so as to give pressure and temperature conditions as near to "straight-line" conditions as possible.

(4) Experience suggests that vapour phase plants will operate quite automatically, and in a foolproof manner, when producing a concentrated gas liquor of 18 to 19% ammonia by weight. If it is desired, however, to increase the concentration to 20–22%, then provision should be made for introducing steam at critical and predetermined points, and systematic purging for two or three hours each week should be arranged. The most critical position is that immediately preceding the vapour outlet of the primary condenser.

(5) Vapour phase plants frequently operate with exhaust steam at a pressure of 7 lb. per sq. in., and where such steam is available there can be no doubt that this constitutes a definite economy. Where it is intended to use exhaust steam intimation should be given to the contractors, as obviously the port area of the steam inlet valve and the perforations of the steam distributing pipe will require to be suitably enlarged.

At this juncture it will perhaps be desirable to give some typical results of the operation of vapour phase plants. Some of these results relate to emergency plants, others to the more elaborate form of unit.

Some considerations relating to the introduction of a vapour phase type of concentrated gas liquor plant at Perth, with an indication of our experience, will doubtless be of interest to the Members of the North British Gas Association.

In 1904 a sulphate of ammonia plant was installed by Joseph Taylor, Ltd., of Bolton. This plant was capable of producing two tons of sulphate of ammonia per 24 hours. It consisted of a Gillespie preheater, a 3-ton per day Gillespie still with liming section and lime mixer, and an open type saturator. The salt was hand-fished on to a draining table. At a later date a 2-ton per day centrifuge, manufactured by Watson Laidlaw & Co., Ltd., was installed. Foul gas, after passing the preheater and atmospheric condenser, was led to two purifiers connected in parallel for alternate use.

The use of lime was discontinued some years ago and the plant worked for the recovery of free ammonia only. Meantime, the still, atmospheric condensers, and purifiers remained in a satisfactory condition, and continue to be usefully employed.

By 1941 this plant had reached a state of dilapidation, as might be anticipated after 37 years' continual operation. The final denouement was hastened by the collapse of the saturator, and this led to an examination of the most economical method of dealing with by-product ammonia. This problem is still being actively studied, and it occurred to the author immediately concerned that his experience should be given, and that the considerations herein outlined should be published along with appendices especially designed to provide a background of information for others who may be interested in or confronted with this or a similar problem. [These are omitted from this extract of the Paper.]

With this in view, the first aspect of importance is the final balance-

* Copyright publication No. 266, Inst. Gas Engineers.
† Publication No. 213/90, Inst. Gas Engineers, *By-Product Ammonia.*

TABLE III.

	A. Gall.	B. Gall.	C. Gall.	D. Gall.	E. Gall.	F. Gall.
1. Gas liquor distilled	281	235	325	450	—	275
2. Steam to still	8–10 lb./sq. in.	6.5	12	Waste heat steam 6–7	8	—
3. Pressure at still base	½ lb.	1.7	1.5	—	—	—
4. Stillhead temperature	80–82° C.	84–84.5°C.	85°C.	81.0°C.	81.0°C.	85°C.
5. Temp., dissociated gases	55°C.	54.5°C.	58°C.	58°C.	54°C.	55.5°C.
6. Temp., gas liquor to still	38°C.	37–39°C.	—	—	—	—
7. Temp., gases to scrubber	55°C.	54°C.	57°C.	57.6°C.	—	55.5°C.
8. Gas liquor feed to scrubber temperature	32°C.	27–29°C.	20°C.	—	—	—
9. Vol. of gas liquor	132 gall./hr.	—	80 gall./hr.	180 gall./hr.	—	65 gall./hr.
10. Vol. of water to scrubber	36 gall./hr.	25	—	—	—	20 gall./hr.
11. Temp. of resulting gas liquor	40°C.	37–39°C.	40°C.	—	—	—
12. Ditto of C.G.L.	27°C.	29–31°C.	—	—	—	—
13. Steam used metered	436 lb./hr.	—	—	—	—	—
14. Concentrated gas liquor:						
% NH_3/Wt.	20–22	18.53	18.7	18.75–19.0	16.5	20.07
% CO_2/Wt.	20	—	20.7	—	—	22.00
% H_2S/Wt.	—	—	1.67	—	—	—
15. Scrubber liquor:						
% NH_3/Wt.	4.08	—	7.8	4.0	—	—
% CO_2/Wt.	4.23	—	4.58	4.5	—	—
% H_2S/Wt.	—	—	—	—	—	—
16. Feed tank liquor:						
% NH_3/Wt.	2.87	—	1.22	2.17	—	—
% CO_2/Wt.	3.20	—	1.85	—	—	—
% H_2S/Wt.	—	—	0.039	—	—	—
17. Effluent % NH_3/Wt.	0.04	—	—	0.007	—	—
18. How effluent gases (H_2S, CO_2, &c.), are treated	Oxide heap	Oxide heap	Oxide heap	Withdrawn to foul gas main	Oxide heap	—

sheet for the manufacture of sulphate of ammonia during the year ended May 15, 1941, and details are subjoined—

	£	s.	d.
Acid	4	1	4
Steam	1	3	0
Maintenance	1	4	2
Labour	2	0	9
Levy	1	2	9
Depreciation		—	
Interest		—	
Total	9	12	0
Revenue allowing for stock difference	8	7	4
Loss	£1	4	8 per ton

The quantity of steam is estimated at 6.6 tons of steam per ton of sulphate of ammonia manufactured, and the price is assumed to be 1s. 6d. per 1,000 lb. of steam, or 3s. 4d. per ton.

The maintenance figure of £1 4s. 2d. per ton is high, as might be expected. With a new plant an average figure of 10s. would probably meet this item.

Equally, with a modern plant, there would be amortization of capital and interest, and these additional charges would clearly aggravate the position if a new sulphate of ammonia plant had been installed. Further, it is evident, from the figures, that the installation of a new saturator would not convert the process into an economical one.

A decision, however, could not be taken merely on a balance-sheet derived from an obsolete plant. Apart from certain local interests the Industrial Ammonia Controller's department expressed the view that, so long as this plant could continue to operate and be maintained as a source of sulphate of ammonia in an agricultural community, it was fulfilling a local need, and economizing transport of fertilizers. Thus, conceivably it would have been advantageous to have restarted the plant by arranging economical repairs or replacement. To this end the Industrial Ammonia Controller was prepared to meet the necessary cost. The usual outlet for sulphate of ammonia at the close of the year is for mixing purposes, as Perth is surrounded by an agricultural community, and more than one fertilizer mixing works exists in the immediate vicinity. The advantage to local farmers of having a local supply is obvious. If a new type of saturator had been installed it would have been possible to reduce working costs by using an arsenical acid obtainable from a nearby chemical works at a reduced price, and also at a smaller carriage rate.

On balance it seemed clear that the manufacture of sulphate of ammonia at a medium-sized works at least could, with difficulty, be justified, and it was manifestly desirable that some other more economical process for the recovery of ammonia should be found.

The Perth Plant

It was ultimately decided to install a Thorncliffe-Baldurie type of vapour phase plant (patent No. 494,023), of which a diagrammatic illustration and flow sheet is given in fig. 1, which is self-explanatory.

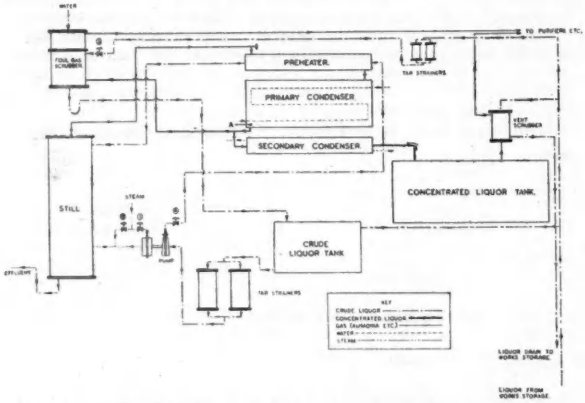


FIG. 1.—*Automatically controlled vapour phase plant for concentrating ammoniacal liquor.*

Fig. 2, which shows the general arrangement of the plant as now operating, clearly indicates the component parts of the plant, its connexions and other features, and does not call for further verbal description.

Hitherto this type of plant had operated without serious hitch, but slight difficulties arose when producing a concentration of 20–22% ammonia by weight. To overcome these difficulties, a rearrangement of the preheater-condenser block was made, largely to ensure greater flexibility of working and to economize the use of cooling water. Clearly, if a product containing 22% of ammonia by weight is required, an appreciably greater decarbonation is necessary, and this entails better separation of ammonia and CO_2, and better preferential absorption of the ammonia in the primary condenser.

Fundamentally, if a greater proportion of CO_2 is to be removed from the circuit, then the temperature of the dissociated gases must be raised. The outcome of this is that more ammonia also passes to the scrubber while the ammonia content of the product is reduced in consequence. To avoid this loss of ammonia, and to prevent crystallization, a weir was installed, details of which are given in fig. 3. The weir serves a dual purpose. It provides additional surface area for preferential absorption of ammonia, and increases the velocity of the gases in contact with the condensed concentrated gas liquor, thereby also increasing the liquid flushing action on the top portion of the tubes.

It is doubtful whether it is expedient to aim at too high an ammonia concentration. Rather is it desirable to fix as a standard a slightly lower concentration. More often than not, when working to a slightly

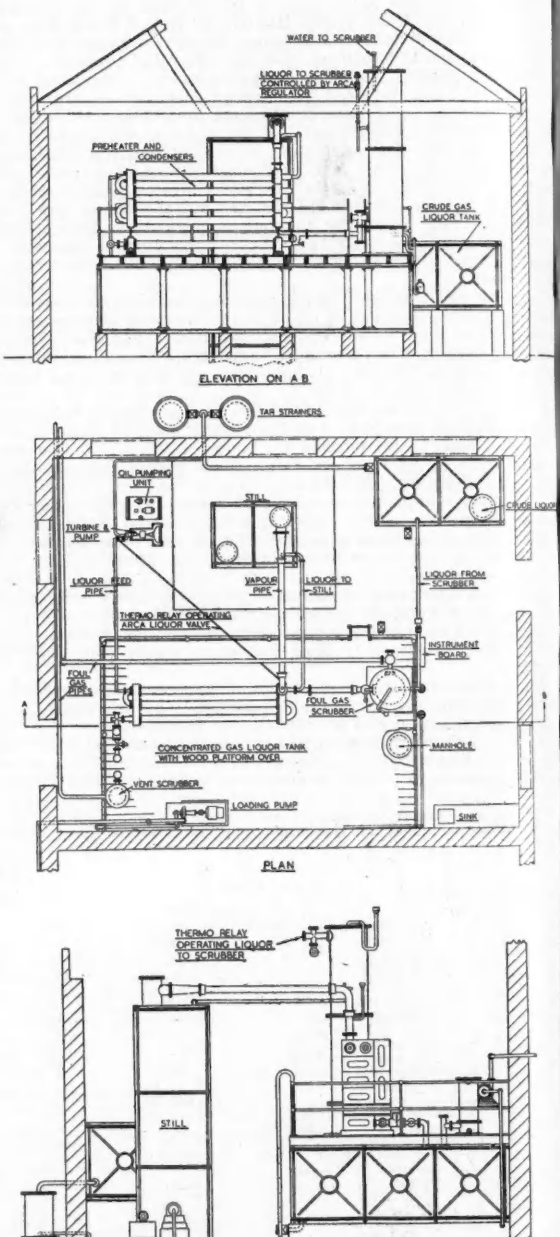


FIG. 2.

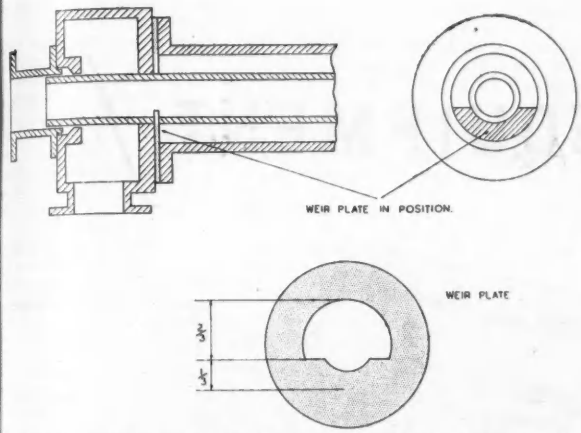


FIG. 3.—*Design and position of weir plate fitted to last tube of primary condenser.*

lower standard one obtains a consistently higher product than if too high a standard is continually aimed at.

The circulation of ammonia in the plant described has been carefully checked, and the following figures represent average working conditions:

Circulation.

A. Gas liquor to feed tank/hour=191 gall. free NH_3 1.5% S.G. 1.021.
B. Gas liquor to foul gas scrubber/hour=95 gall. free NH_3 1.5% S.G. 1.021.
C. Fortified gas liquor from scrubber=95 gall. free NH_3 3.77% S.G. 1.036.
D. Mixed gas and fortified liquor from feed tank to still/hour=286 gall. free NH_3 3.23% S.G. 1.025.

Free ammonia in A. $\frac{191 \times 10.21}{100} \times 1.5 = 29.25$ lb.

" " B. $\frac{95 \times 10.21}{100} \times 1.5 = 14.50$ lb.

" " C. $\frac{95 \times 10.36}{100} \times 3.77 = 37$ lb.

" " D. $\frac{286 \times 10.25}{100} \times 3.23 = 95$ lb.

Of the total ammonia—95 lb. fed to the still per hour, 22.5 lb. (C–B) represent the ammonia arrested from the dissociated gases. In other words, 23.81% has to be re-distilled.

In the above connexion it should be remarked that the quantity of gas liquor fed to the foul gas scrubber is thermostatically controlled by the temperature of the foul gases leaving scrubber No. 3. The principal object of this relay is to ensure that the foul gases emerge at a temperature not exceeding 40°C. or thereabouts, according to the composition of the gas liquor being processed. These foul gases are finally washed by a fine spray of water, the quantity of which is controlled by a small governor and a fixed orifice.

Care should be exercised in the operation of the gas liquor scrubber of a vapour phase plant if the best separation of CO_2 is to be effected.

Obviously, the specific purpose of this part of the process should be to ensure preferential absorption of ammonia. If the temperature of the gases entering the scrubber is maintained at about 55°C., the heat of absorption and solution of ammonia and the heat of formation of ammonium carbonates, &c., are such (the temperature within the scrubber at the bottom portion reaches 75°C.) that only ammonia can be absorbed, and as the gas liquor fed to the scrubber contains no ammonium hydrate, the presence of excess CO_2 in the gases reaching the top portion of the scrubber can only result at most in the decomposition of ammonium sulphides, the discharge of H_2S and the formation of an additional small quantity of ammonium carbonates.

If, of course, the gases enter the scrubber at temperatures appreciably less than 55°C., with a correspondingly less quantity of ammonia, conditions may arise where there is little preferential absorption of ammonia.

Again, if gas liquor enters the scrubber at a temperature above 15°C. the vapour pressure will be such that ammonia will pass, and extra precautions will need to be taken to wash finally with an adequate supply of clean water of 10°–15°C.

A word or two should be said about the "Arca" controls, which are oil-operated. A small electrically-driven oil pump and storage system to supply oil to all the regulators has been installed, and, in addition, on the drain pipe from each of the pads, glass-covered sight feeds are provided. Experience to date with oil as the medium for the "Arca" regulators has been most encouraging. After working for over a year no difficulty has arisen. On the contrary, all the valves, moving parts and diaphragms are obviously operating in a medium which is most suitable for their continuous and useful life. Since the sight feeds are covered, no extraneous matter can reach the oil circuit while the operation of the regulators can be readily assessed by the quantity of oil passing through the sight feed.

The utilization of the existing sulphate of ammonia still raises rather an interesting point, because under sulphate conditions it had a greater capacity than was to be expected under concentrated gas liquor conditions. Originally it was capable of dealing with 580 gallons of gas liquor per hour, when operating in the manufacture of sulphate of ammonia, but under the new conditions its capacity is reduced approximately to 350 galls. per hour. It has, however, to be remembered that the concentration of ammonia of the steam-ammonia stream under sulphate conditions is only 10%, whereas under concentrated gas liquor conditions, where the top portion of the still serves as a dephlegmator, the steam-ammonia stream leaving the still has an ammonia concentration of 20–22%. This illustrates the reduction in distilling capacity, which has to be taken into consideration when using an existing sulphate of ammonia still in a concentrated liquor process plant.

An electrically-driven pump is used to load railway tank wagons with the concentrated gas liquor. It was desired to effect the loading of a tank in one hour at most, so as to take advantage of the dinner-time, and to avoid any dislocation of traffic at the sidings. At the same time a certain amount of ammonia is invariably lost in the operation of filling rail tanks, so that the less time taken the less these losses will be. A rotary pump allows a further convenience of hand control at the loading point on the railway siding.

The Cambridge Plant

Enquiries about the results of the working of the Cambridge plant, of which interesting details were furnished in the 1939 Institution Paper on this subject, have recently been made. It has to be remembered that this plant was somewhat unusual. Originally it was erected as a straight plant, but subsequently it was modified to vapour phase conditions. Mr. Rioch, the General Manager, and his Chief Chemist, Mr. Winch, have favoured us with additional information about their experience during the last four years. The plant still continues to work with a still-head temperature of 82°C., and a temperature at the outlet of the split condenser of 46°C. The gas liquor used at the scrubber for the dissociated gases represents about 15% of the volume fed to the still.

It is essential, when operating under the foregoing conditions, to raise the strength of the gas liquor to 12 oz., that is, 2.6% of ammonia, representing approximately 1.95% free ammonia. The specific gravity of the concentrated liquor is 1.10, and the strength 18% ammonia/wt.

The corrosive troubles which were experienced in 1939 have been less marked, but difficulty is still being met with the stem of the thermograph recording the temperature of the gases in the pipe from the split condenser. Antimonial lead is unsatisfactory, as indeed is ordinary lead covering. Recently a vitreous enamel-covered stem has been used, but this serves only for some six weeks, and then requires attention. Antimonial lead with 6%, 8%, and 10% of antimony has been tried, but there appears to be no difference between these several mixtures. They are all susceptible to "creep"—*i.e.*, there is expansion without a corresponding contraction, over an unlimited period. Even bright steel tubes, when carefully lead-coated, reveal the same tendency to creep. Glass or vitreous enamel coating would be ideal, but there are differences of thermal expansion between the steel tubes and the glass or vitreous enamel, and this doubtless accounts for fractures.

There is an insistent need for a special metal that will meet the peculiar conditions to which stems are exposed.

It should be possible to get an enamel the coefficient of expansion of which closely approximates that of steel.

General

If concentrated gas liquor is to be manufactured economically, gas liquor must be produced of satisfactory quality and strength. The saving in steam alone when processing gas liquor of 2% free ammonia, in contrast with 1% free ammonia, is 9s. per ton of concentrated gas liquor, based on steam at 4s. 6d. per ton. This represents an economy of 5.4d. per unit.

Wherever possible, it is advisable to use waste heat steam, because of its lower cost.

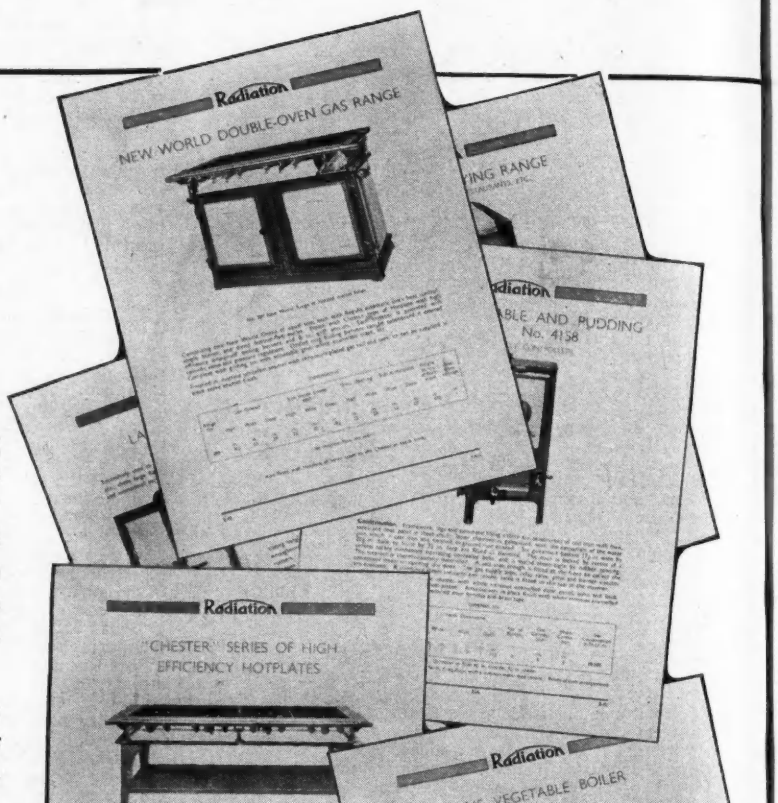
The larger the production unit for concentrated gas liquor, the cheaper the final product. The difference of price between a unit of plant of a capacity of 3 tons per day and one of 20 tons capacity per day of concentrated gas liquor is not, however, appreciable.

Concentrated gas liquor stills, if properly designed and fabricated, should serve for at least 30 years. Depreciation is not serious. It is, however, quite another matter with the concentric preheaters and condensers. Corrosion at some works is very slight; at others it is more serious and this is a problem that is being actively investigated.

Little unskilled labour is required in the manufacture of concentrated gas liquor. Chemical supervision can be developed in such a way that at larger works 6d. per ton should adequately cover this item. Clearly, one must know intimately the vagaries of one's plant, and this takes time. Thorough familiarity with a plant, once achieved, however, promotes respect, which in turn not only gives pleasure, but expresses itself handsomely in reduced supervising costs.

Generally far too much water is used with "Arca" controls. In any case this water costs money, and instead of being wasted should

MODERN EQUIPMENT *for*



Gas Undertakings receiving enquiries relating to the provision of equipment for bulk catering are offered the specialised assistance of Radiation Ltd., whose experience in this field is long and varied.

Radiation Ltd. supply all the most modern designs of apparatus, including every requisite for complete canteens, with snack bars and other accessories.

The Kitchen illustrated opposite is a further addition to the list of Mills which have installed Canteens equipped with Radiation Gas Cooking Apparatus. A Roaster is also included, but not shown in the photograph, and the Canteen caters for 450 persons.

be passed to the boilers for use in the generation of steam, or re-used in some such manner.

Atmospheric coolers should be installed wherever possible in order to economize in the use of condenser cooling water. In this way the consumption can be reduced, usually by as much as 90%, which represents a saving of no mean order.

Attention to the controls pays handsomely, as indeed does cleanliness.

Since 1941 product ammonia has been responsible for an advance in the price of the sulphur unit of spent oxide, and what this means is indicated below; but still better ammonia recovery may well bring an additional guerdon.

Generally speaking, the price of the sulphur unit of spent oxide has advanced since pre-war by about 7d. Most gas-works recover half a unit of sulphur per ton of coal carbonized—that is, 11.2 lb.—and this represents, on the foregoing basis, 3½d. per ton of coal carbonized. A works carbonizing 35,000 tons of coal per annum, therefore, will receive, *via* product ammonia, an additional income of £510 8s. 4d. from the sale of spent oxide. A works carbonizing 175,000 tons of coal per annum will correspondingly receive £2,552 1s. 8d.

While it is not suggested that the above increased revenue covers additional expenses in the matter of ammonia recovery and increased costs in the removal of H_2S from crude coal gas, it does represent some contribution towards offsetting these costs, and the Gas Industry does not appear to realize precisely the significance of what has been arranged in this connexion.

One final word to renew emphasis about the inter-relationship of ammonia and sulphur. Ammonia is not being recovered satisfactorily at many gas-works. Important undertakings fail to account for 3 lb. of ammonia per ton of coal processed. The cumulative effect is serious. There are only three important demands for the sulphur of spent oxide. One is for the fixation of ammonia, the other is a relatively minor continental demand, at present unavailable, and a third will need to be developed for the treatment of phosphate rock. This country's stock of spent oxide before the war was about 70,000 tons; to-day the stock is more than 120,000 tons. Spent oxide is controlled privately. Prices will fall, to the financial disadvantage of the Gas Industry, unless more ammonia is recovered to absorb some of the surplus sulphur as spent oxide.

Bi-Centenary of Lavoisier

August 26 was the bicentenary of Antoine Laurent Lavoisier, who was born on Aug. 26, 1743, and died by the guillotine on May 8, 1794. *The Times* contained a brilliant commemorative note from the pen of Sir Harold Hartley, from which we take the following few extracts:

Lavoisier is one of the immortals. In the whole history of science there is no transformation so swift and dramatic as when in 1789, in his great Treatise, he gave chemistry its modern form, sweeping away the cobwebs of centuries which obscured its progress. His theory of combustion is well known, but his services to chemistry have tended to hide his achievements in other fields.

He was a child of his age. Bred in France at a time when the writings of Voltaire and Rousseau were stirring men's minds, and Diderot and the Encyclopaedists were widening their vision, Lavoisier was a great reformer. Ambition, curiosity, humanity, and love of action took him into many fields, and in each his creative mind saw an opportunity for constructive work. The six great volumes of his collected writings display an amazing intellectual and practical achievement. In chemistry, in physics, in physiology, in chemical engineering, in agriculture, in geology, in education, in statistics, and in finance he was a pioneer, and in each his contribution has the modern touch both in thought and phrase.

The marvel is that with his widespread interests it was he alone out of a band of brilliant contemporaries like Black, Cavendish, Priestley, and Scheele who had the vision of modern chemistry and gave it life. Alone among the intellectuals Lavoisier was a man of affairs, skilled in administration and finance, and that is in some measure the secret of his success. For it might be said of him that he applied not only the balance but the principle of the balance-sheet to chemistry and physiology.

From geology his thoughts turned to chemistry, and he soon hit on combustion as the outstanding problem to be solved. Its solution depended on the study of gases which had been neglected for nearly a century since the days of Boyle, Hooke, and Mayow. Chemists had universally accepted a theory that things burn because they contain an inflammable principle called phlogiston. Lavoisier's experiments showed him that phosphorus and sulphur increased in weight during burning. To his practical mind increase in weight meant gaining something, not losing it, and he saw here the possibility of "a revolution in chemistry and physics." It was no easy quest, as he had little chemical experience, but he relied on measurement to tell him what was happening, and his conviction remained unshaken until success came 12 years later.

Luckily there were others in the hunt. Priestley, Cavendish, and Black before them were studying gases and from each of them Lavoisier learned much, but he alone saw the true explanation of their discoveries. In 1774 Priestley told Lavoisier he had got a gas in which a candle burnt brilliantly by heating the calx of mercury.

Lavoisier continued to follow Priestley's clue until, in 1777, he had convincing proof that combustion was due to combination with a gas in the atmosphere which he named oxygen, as he thought it was the essential constituent of all acids. This was a great advance, but there were still difficulties to be solved. Lavoisier was puzzled about water: was it an element or a compound? Cavendish, in 1783, showed that water was formed when inflammable air from metals was burnt with oxygen. This was the clue Lavoisier needed, and he named the inflammable air hydrogen, or water producer. Just afterwards Cavendish showed that the inert part of the atmosphere gave nitric acid when sparked with oxygen, whence it got the name of nitrogen.

Lavoisier's mind was now clear. He could explain the composition of chemical compounds, their reactions, and their quantitative relations quite simply without the help of phlogiston. His French colleagues quickly rallied to his side. With three of them in 1787 he devised a new nomenclature in which the elements and compounds were given the systematic names we still use to-day. The year 1789 saw the publication of his great treatise, which marked the birth of modern chemistry and threw a new light on all the related sciences. In physiology Lavoisier himself solved the riddle of respiration. It was the beginning of the modern theory of metabolism and the end of Lavoisier's scientific work, as in 1789 he was engulfed in another Revolution.

Stamford and St. Martin's Gas Light and Coke Company.—Interim dividend of £7% (actual), less tax.

A Cablegram has been received by Messrs. William Coward & Co., Ltd., from the Metropolitan Gas Company of Melbourne to the effect that dividends were posted on Aug. 27—5s. per share final dividend. The net profit for the year ended June 30 is £157,615, transfer £10,000, and carried forward £84,998.

Political and Economic Planning has just issued a broadsheet (No. 210) on the Gas Industry in Wartime, the single purpose of which is to bring up to date the PEP Report on the Industry published in 1939. It is a strictly factual document, and is not concerned with problems of the future. It is in keeping with Planning No. 197, Coal and the War, and No. 204, Facts about Electricity; and the three broadsheets represent part of the raw material for a later report on fuel policy. Work is now proceeding on the final report, which will integrate and bring up to date the three pre-war reports on coal, electricity, and gas industries.

The St. Austell Gas Company, Ltd., recently gave the G.T.C. in the district their first course of lectures, which included cleaning and maintenance of gas burners and gas cookers, meter reading, and the manufacture of gas, including a visit to the gas-works. The girls and their Officers were most interested. At the Domestic Front "Make Do and Mend" Exhibition held at St. Austell the Company was invited to have a stand. The exhibition was held for two days, and school-children showed great interest in the by-products and meter reading displays.

A Marked Improvement is shown in the results of the Alliance and Dublin Consumers' Gas Company for the half-year ended June 30. Profits on revenue are shown at £70,620, which compares with a loss of £63,896 for the previous six months and a profit of £9,323 for the corresponding period last year. The Directors have declared a dividend of 1% actual, less tax, on the Consolidated Ordinary Stock, which involves a withdrawal of £22,890 from reserve. In the previous six months no dividend was paid on the Ordinary Stock, while for the six months to June 30, 1942, the dividend of 2½% actual, less tax, necessitated the withdrawal of £22,092.

The British Coal Utilization Research Association is arranging a Conference on Nov. 10 and 11 to discuss the problems related to the utilization of small coals, with particular reference to the results obtained by the users of these fuels. The Conference has the support and approval of the Fuel Efficiency Committee. There will be three sessions: 2.30 p.m., Nov. 10, Utilization of Small Coals and Slurries; 10 a.m., Nov. 11, Utilization of Fuels of High Inert Content; 2.30 p.m., Nov. 11, The Upgrading of Fuels. The organizers will be glad to consider offers of Papers for discussion at the Conference, and full particulars will be sent on application to the Conference Secretary, B.C.U.R.A., Rickett Street, West Brompton, S.W. 6.

Commodity Control.—The whole of the Government's control of commodities other than food, whether by Statute or by Rules and Orders, was reviewed in narrative form in *Commodity Control*, published six months ago at 15s. by Messrs. Butterworth & Co. (Publishers) Ltd. A First Supplement of 54 pages (at 3s. plus postage), has now been issued by the same publishers, bringing the original work completely up to date as far as June 1. All amendments are noted in a readily referable manner and all new Orders that have appeared since the publication of the main work are included. A table of all Statutory Rules and Orders mentioned in the Supplement is given in year and number order, and it is claimed that the use of the Supplement in conjunction with the main volume affords all the latest information on the subject. It is emphasized that reference should never be made to the main volume without also consulting the Supplement for any changes and additions.

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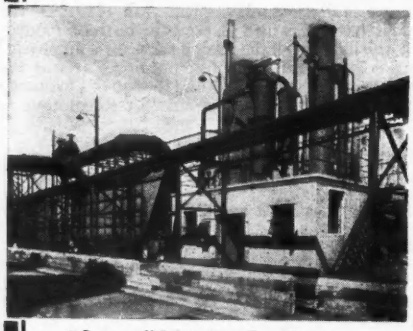

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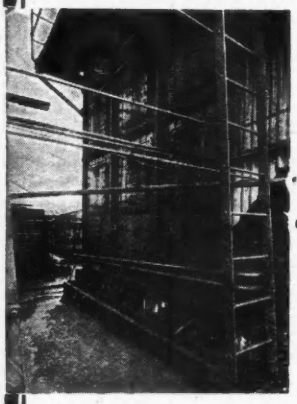

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Products Prices—Stocks and Shares

The London Market Sept. 6.

All Coal Tar Products are in good demand, and Pitch in the London area remains about 45s.

An Order entitled The Control of Toluene (No. 3) Order, 1943 (S. R. & O. 1943, No. 976), came into force on July 20, and introduced certain changes in the prices for different grades of Toluene.

There are no changes to report in the prices of Coal Tar Products.

The Provinces Sept. 6.

The average prices of gas-works products during the week were: Pitch and Crude Tar,* Toluole, naked, North, 90's, 1s. 11d., pure, 2s. 7½d. (controlled by the Control of Toluene No. 3 Order, 1943, dated July 14, operative from July 20, 1943). Naphtha and Xylole controlled by the Coal Tar Naphtha and Xylole Order, 1943, dated May 31 (S. R. & O., 1943, No. 768), operative from June 1. Carbolic acid, 60's, naphthalene, and anthracene controlled by the Coal Tar Products Prices Order S. R. & O. 2509, dated Dec. 7, 1942, and operative from Jan. 1, 1943. Filtered heavy oil (min. gr. 1,080), 7½d. to 8d. Creosote oil has been generally controlled as to direction and price for some time past. Current value—fuel grades 5d. to 5½d.; timber preservation and other purposes 4¾d. to 6d.

* In regard to pitch and crude tar prices we would ask readers to refer to the editorial note on p. 396 of the "JOURNAL" for Sept. 10, 1941.

Tar Products in Scotland Sept. 4.

Deliveries are proceeding rapidly in both home and export markets. Refined tar controlled. Value is 4½d. per gallon *ex* Works, naked. Creosote oil: Specification oil, 6½d. to 7d.; low gravity, 7¼d. to 7½d.; neutral oil, 6d. to 6½d.; hydrogenation oil, 5¾d. per gallon; all *ex* Works in bulk. Refined cresylic acid is rapidly disposed of at 3s. 6d. to 4s. 6d. per gallon *ex* Works, naked, according to quality. Crude naphtha: 6½d. to 7d. per gallon. Solvent naphtha: Basic prices delivered in bulk, 90/160 grade 2s. 8d.; and 90/190 Heavy naphtha. Unrectified, 1s. 10½d.; Rectified, 2s. 3d. per gallon. Pyridine: 90/160 grade 13s., and 90/140 grade, 15s. per gallon.

Business throughout last week continued small, but the general undertone remained firm. Conditions in the Gas Market were much the same as elsewhere, and prices, though all with one exception were maintained, showed fewer changes than for many weeks past. The only feature was the sharp rise of 10 points in Mid-Southern "A" stock in the Supplementary List. There is a long list of gas debenture stocks on offer, a number of which give comparatively high yields with good security, and in the ordinary list a parcel of £5,000 South Metropolitan is available at round about 92. The following changes in quotations were recorded during the week:

OFFICIAL LIST

Bournemouth max. Div.	150—155	+2	
East Surrey "B" (x.d.)	87—92	Aug. 3	
Imperial Continental	92—95	+1	

SUPPLEMENTARY LIST.

East Surrey 5½ p.c. Pref. "A" (x.d.)	110—115	Aug. 30
Ditto 6 p.c. Pref. (x.d.)	120—125	"
Mid-Southern "A"	100—105	+10

PROVINCIAL EXCHANGES

Bristol 5 p.c. max.	113—115	—1
Derby Cons. (x.d.)	121—126	Aug. 9
Glossop Ord. (x.d.)	18—19	Aug. 23
Ditto Half-Shares (x.d.)	9⅝—10½	"
Ditto New Shares (x.d.)	13½—14½	"

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